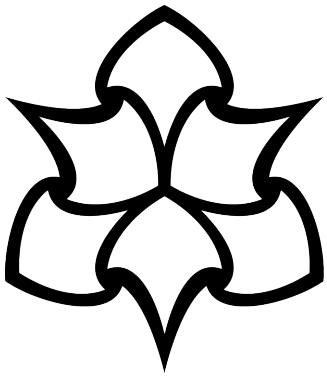

Countermovement jump qualities of elite academy rugby union players

Cameron Owen, Kevin Till, Padraic Phibbs, Dale Read, Jonathon Weakley, Mark Atkinson, Keith Stokes, Sean Williams, Simon Kemp, Ben Jones

Purpose: Identify positional kinetic and kinematic countermovement jump (CMJ) variables of elite Under 18 (U18) academy rugby union players.

Methods: With ethics approval, 166 U18 male rugby union players (front row *n*=35; second row *n*=16; back row *n*=40; half backs *n*=34; centres *n*=15; back three n=26) from six English Regional Academies (age 17.3 ± 0.7 years; height 181.0 ± 8.3 cm; body mass 88.6 ± 14.2 kg) participated in the study. Participants completed two maximal CMJ on two portable force platforms (Pasco PS-2141, Roseville, California, USA) sampling at 500 Hz. The mean of the two trials was used for analysis. Following the testing a custom-designed R-script was used to find kinetic (peak force, mean rate of force development, impulse, peak power and total area under the force velocity curve) and kinematic variables (take-off velocity, jump height, centre of mass displacement and reactive strength index modified) for each jump identifying eccentric and concentric jump phases where applicable. Principal component (PC) analysis was conducted to identify the variance explained by the variables and collinearity. From the first three PCs (i.e., power and force variables [PC1; 35%], impulse variables [PC2; 27%] and velocity variables [PC3; 25%]), variables with the greatest loading factors were selected for analysis using a one-way ANOVA and Tukey Kramer post hoc (α = 0.05) to identify positional differences once normality had been assured.

Results: Significant between position differences were observed for area under the force velocity curve ($F(5,160) = 4.851$, $p = <0.001$), concentric impulse ($5,160) = 21.91$, $p = <0.001$) and take off velocity ($F(5,160) = 10.18$, $p = <0.001$). Positional data and significant post hoc differences are shown in Table 1.

Conclusions: These findings suggest that kinetic and kinematic characteristics in the countermovement jump vary by playing position in U18 academy rugby union players Heavier front row and second row forwards produced greater area under the force velocity curve especially when compared to half backs. Centres were able to produce similar area under the force velocity curve to the front row, however along with the rest of the backs and back row, a significantly lower concentric impulse is observed potentially due to lower force producing capabilities or a shorter force application time. In contrast, all positions except for the second row achieved significantly higher take-off velocities than the front row, with back three players achieving the greatest velocity.

Practical Application: It is essential for practitioners to develop physical qualities that are specific to a given athlete and their role in competition. Results from the present study suggest that a multivariate approach may provide additional information for monitoring neuromuscular performance. The positional differences observed in this study should be combined with knowledge of match demands to determine a suitable training intervention for U18 rugby union players.

Table 1 A comparison of the highest loading variables for each principal component between playing positions for U18 academy rugby union players (mean ± SD)

Playing Position	PC1 Area under the force velocity curve (W)	PC2 Concentric impulse (N.s)	PC3 Take-off velocity ($m.s^{-1}$)
Front Row	6639.7 ± 858.8*	267.4 ± 54.1*	2.38 ± 0.19
Second Row	6531.7 ± 595.5*	234.6 ± 50.1*	2.55 ± 0.18
Back Row	6239.4 ± 1005.6	211.0 ± 42.8†	2.58 ± 0.18†
Half Backs	5630.4 ± 1007.3	168.5 ± 38.0	2.64 ± 0.23†
Centres	6612.4 ± 1054.6*	192.8 ± 34.9†	2.64 ± 0.28†
Back Three	6243.6 ± 970.3	186.6 ± 29.4†	2.73 ± 0.18†#

*Significantly different, $p < 0.05$, compared to half backs
† Significantly different, $p < 0.05$, compared to front row
# Significantly different, $p < 0.05$, compared to back row